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ABSTRACT

This study was conducted to determine if there were differences in strengths and weaknesses of an educational interactive video program perceived by high school students and their parents over a 4-year time span. Parent and student responses to open-ended questions concerning strengths and weaknesses of the interactive distance learning program were first categorized and contrasted by status (student or parent). There were 1,505 respondents (1,024 students and 481 parents). There were no differences in perceived strengths. There were, however, differences detected in weakness responses based on status. Loglinear models were then used to examine strength by status by site (home/remote), strength by status by semester, weakness by status by site, and weakness by status by semester. Statistical significance was detected in all models. Results are discussed. (Contains 6 tables, 6 figures, and 18 references.) (Author/SLD)

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ED 435 706

High School Student - High School Parent: Are there Differences in Perceived Strengths and Weaknesses of an Educational Interactive Video Program?

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Abstract

The purpose of this study was to determine if there were differences in perceived strengths and weaknesses of an educational interactive video program between high-school students and their parents over a 4-year time span. Parent and student responses to open-ended questions concerning strengths and weaknesses were first categorized and contrasted by status. There were no differences ($p \geq .05$) in perceived strengths. There were, however, differences detected in weakness responses based on status ($\chi^2 = 192$, df=3, $p < .01$). Log-linear models were then used to examine strength by status by site (home/remote), strength by status by semester, weakness by status by site, and weakness by status by semester. Statistical significance was detected in all models. Results are discussed.

High School Student - High School Parent: Are there Differences in Perceived Strengths and Weaknesses of an Educational Interactive Video Program?

Increased use of interactive video (ITV) for distance learning students has made classes previously inaccessible to rural high school students available locally (Monaghan, 1996). Offering college courses at remote sites by interactive video permits students to take the class without a lengthy drive. In some localities homebound students may now partake of classroom interaction by interactive video. Thus, we may perceive interactive video as a means of providing equal educational opportunities to all students. There are, however, questions concerning this program.

Although interactive video technology has advanced rapidly in recent years, there is increasing evidence that no one technology works in every application (Linking, 1989). In addition, the technology utilized by interactive video requires a different preparation for teaching than traditional methods (Knapczyk, 1993). While the expenditure required for interactive video may be less than providing on site teachers (Morgan, 1994; Villarroel, 1988) or may provide access to equal educational opportunities in rural areas, there is an increasing need for research into and evaluation of the effectiveness of interactive video programs. Evaluation of programs, however can be costly. Although convergent information from different sources provides evidence of validity, if information collected is redundant, the expense of collecting and analyzing data could be used more beneficially.

The primary purpose of this study was to determine if there were differences in the perceived strengths and weaknesses of an educational interactive video program between

participating high school students and their parents. Yearly results have been utilized to provide improvements to the program. If, however, both parents and students provide the same information, data collection can be limited to only one group.

Literature Review

Distance Education

The basic criterion for distance education is distance between the teacher and the student. Distance education is not new. This technique was begun in the nineteenth century with correspondence education (Klesius, Homan, & Thompson, 1997). It has, however, changed from the correspondence delivery method, through radio methods, to today's computer and interactive video techniques.

Currently, distance education has been used for high school students as an alternative method to earn credentials in the General Education Development (GED) program, to obtain college credits (Green, 1996), or in attempts to revitalize curricular programs (Fucci & Hueston, 1997). Some universities have developed dual degree partnerships with interested businesses to provide on-site, on-demand graduate programs (Haynes & Pouraghabagher, 1997). And, some universities have developed programs to deliver education to rural areas or cultural groups (Monaghan, 1996).

Prior researchers in distance education have investigated student satisfaction, communication techniques, teaching behavior, and change fostered (Moore & Thompson, 1990). Because distance education places students in the situation in which there may be no interaction or association with other students or the teacher, system requirements must be sound (Gunawardena, 1988; as cited in Dillon, Gunawardena, & Parker, 1992). Carter (1997) found that

audio was the most important element of interactive education, followed by lighting.

In addition, the importance of the role of the teacher or facilitator has been stressed by several researchers (Garrison & Baynton, 1987 as cited in Dillon, Gunawardena, & Parker, 1992) and interaction with the instructor has been central to the success of a distance education program. When a distance education program has active support, some researchers have found no differences in program rating between home and remote sites. Thyer, Polk, and Gaudin (1997), however, reported that live instruction was rated significantly higher at a college campus than distance learning. They add that distance learning has not yet demonstrated comparable outcomes in terms of student learning.

Developing courses for distance education can be extremely expensive. A properly equipped distance education classroom may cost more than $75,000 (Swift & Wilson, 1997). In addition, there are other costs including instructors training. Although the use of distance education provides the obvious advantage to take otherwise unavailable classes, as the role of distance learning expands, it is essential that the problems unique to this format be examined (Wilson, Litle, Coleman, & Gallagher, 1997/98). What do students perceive as advantages and disadvantages of the distance education program? How do programs change over time? There is also the traditional problem of how to analyze the data collected.

Data Analysis

In analysis of open-ended questions, many times responses are summed to categories and the categories contrasted by chi-square (χ^2) goodness of fit. Categories may then be cross-classified by another factor and independence of variables tested by the χ^2 test of independence. Categories may again be cross-classified by a second factor and the process repeated. This

procedure leads to multiple significance tests and provides no method to assess interaction of more than two variables.

Fienberg (1989) says that "the use of multiple two-dimensional tables to analyze data fails to distinguish the relationship when other variables are present, does not permit simultaneous examination of the relationship, and ignores higher-order interactions" (p.1). In addition, the use of multiple tests of significance inflates the type I error rate. Log-linear modeling, on the other hand, permits the user to assess interaction between multiple variables. Thus, a log-linear model provides a better measure to assess multidimensional categorical data.

Bakeman and Robinson (1994) compare the use of a log-linear model to hierarchical multiple regression. Regression predicts scores for an individual. Log-linear modeling predicts scores for a cell. The degrees of freedom for regression are based on number of subjects. The degrees of freedom in log-linear modeling are based on number of cells as is χ^2. Both, however, may use multiple predictors to build the model.

Method

Measurement

The original survey instrument consisted of demographic information (school, gender, grade, etc.), some 5-point Likert style questions, and three open-ended questions concerning strengths, weaknesses, and suggested improvements for the interactive video program. Two of the open-ended questions (strengths and weaknesses) were used for this analysis.

Each of the open-ended questions was followed by three blank lines indicating each respondent could provide three answers. For this analysis, each response was considered to be independent. That is, each individual response to the open-ended questions is the unit of analysis.

Subjects

High school students enrolled in an interactive video class at a facility in a rural Applachian area during the Spring semesters of 1995, 1996, 1997, and 1998 and the Fall semester 1997 were surveyed. Surveys were administered during the regularly scheduled class time by the class instructor or remote facilitator. In addition, similar questionnaires were sent to the parents via the students.

Responses to the strength and weakness questions were coded based on the response. After determining similarities of the responses, these were placed in categories. For example, the strength's response "previously unavailable class" was coded as '8'. It and the responses "less driving" and "classes in my area" were then summed to a major category "access."

Results

Strengths

There were 1505 respondents (students = 1024; parents=481) included in this comparison for the four survey years (5 semesters) in this analysis. One or more answers to the open-ended question concerning strengths were provided by 936 students yielding a total of 2333 responses. One or more answers to the strengths question were also provided by 274 parents yielding a total of 434 responses. The number of students and parents responding by semester and site as well as the number of corresponding responses is depicted in Table 1.

Insert Table 1 About here

Strengths of the interactive video program were summed to form five major categories:

access, sociability, learning, student behavior, and other. Access included responses such as, classes available at a remote site, more can take, wider access, and take previously unavailable class. Sociability included responses such as, meet more people, interaction with other schools, and meeting different schools. The student behavior category included responses of greater student responsibility, and increased listening. The learning category contained responses such as instruction, technology exposure, and more interesting. The other category was included for all responses that could not be summed to a major group. Included in this category is saves money, none, etc. Parent responses were coded in a similar manner.

Because there was a large difference in number of responses per status group (student/parent), strength responses were initially examined graphically. Approximately 28% of both parents and students cited learning as a strength. This was followed by sociability and access by both groups. The proportion of responses in the 'Other' category for both parents and students was less than 5% as depicted in Figure 1. Because this response could affect overall findings, the other response was removed from further analysis.

Insert Figure 1 About here

The current analysis was concerned with whether it was necessary to collect parent data as well as student. Consequently, responses were first analyzed by status alone. Although the proportion of parent responses citing learning as a strength was higher than the proportion of student responses, there was not a statistically significant relationship (χ^2 =7.35, df=3, p=.06)[1].

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[1]Reported χ^2 is Likelihood Ratio for all models.

The next analysis of this data used hierarchical log-linear modeling. In this procedure, a fit is produced for estimating the number of responses in each category. For example, if site is a good predictor of number of respondents for the categories of strength (access, sociability, learning, and student behavior), site is included in the model. Likewise, if survey year is a good predictor of strength category, it is included in the model. These results could also be obtained using a chi-square test of independence. Status, site, survey year, and strength, however, could not be included in the same model. Thus, we could not test interactions between the factors. The log-linear model tests this interaction.

Although it would have been desirable to analyze strength responses by status, site, and semester concurrently, when splitting responses into a 4 (strength category omitting other) by 2 (status= parent/student) by 2 (site= home/remote) by 5 (semester), several cells contained very small or zero frequencies. Consequently, two models were tested: strength by status by site and strength by status by semester.

When strength responses were analyzed by status and site, the best fitting model contained three two-way interactions (between strength and site, between status and site, and between strength and status), but no three-way interaction between strength, site, and status (χ^2 =6.16, df=3, p=.10). Ninety-one percent of the variance was explained using this model. [2] Results of removal of each interaction effect are displayed in Table 2.

Insert Table 2 About here

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[2]Variance explained is Q^2 as described by Bakeman and Robinson (1994).

Because each previous yearly analysis had indicated a relationship between strength and site, an interaction effect between these was not surprising. And, because of the discrepancy in sample size between groups, it was not surprising to have an interaction between site and status. The prior analysis of status by strength, however, indicated there was no relationship so an interaction between these variables in this analysis was not expected. Thus, the interaction between strength and status was removed from the model to determine if this was of any practical importance. The model containing the interactions between strength and site and between status and site produced a non-significant χ^2 change of 7.2 with 3 degrees of freedom (χ^2 =13.40, df=6, p=.04). This model explained 78% of the variance.

Remote site respondents (parent=34%; student=31%) cited access to classes as a strength of the program with greater proportional frequency than home site respondents (parent=16%; student=23%). On the other hand, home site respondents (30%) cited sociability as a strength with greater proportional frequency than remote site respondents (18%; 23%). Parents (34%) reported learning as a strength with greater proportional frequency than students (25%). These results are depicted in Figure 2.

Insert Figure 2 About here

Strength responses were then analyzed by semester and status. There was a three-way interaction between strength category, status, and semester. Removal of this interaction resulted in a model in which only 41% of the variance was explained (χ^2 =188.60, df=12, p<.01). The results of removal of each interaction are displayed in Table 3.

Insert Table 3 About here

More than 80% of the parent responses during the spring 1997 semester cited learning as a strength. Parents cited sociability and access with decreasing frequency through the Spring semester 1997 and more frequently the following 2 semesters. Student responses concerning sociability as a strength were highest in 1995 at 40% and appear to have stabilized at about 20%. Proportions of student responses concerning access, learning, and other have not changed over time. On the other hand, student behavior is more frequently cited by students as a strength across semesters. This information is depicted in Figure 3.

Insert Figure 3 About here

Weaknesses

At least one response to the weakness question was given by 892 high school students providing a total of 2044 responses. In addition, 245 parents responded to the weakness question providing a total of 402 responses. The number of respondents for each semester and site as well as the number of responses is displayed in Table 4.

Insert Table 4 About here

Weakness responses were coded by response and summed to form five categories: equipment, instruction, student behavior, scheduling, and other. The equipment category consisted of sound, camera, and equipment failure. Instruction included responses such as one-on-one difficult at remote, teacher attention divided, and lack of personal contact with teacher. The student behavior category contained responses such as, easy to cheat at remote, noisy, and pay less attention. Scheduling consisted of scheduling conflicts, different snow schedule, holidays not the same, and class times not the same. Other contained any response that could not fit in another category such as no field trip, need more space, and none.

Initial inspection of the weakness responses resulted in removal of the other category from further analysis. Because the primary intent of this study was to determine if additional information was added by surveying both parents and students, this data was initially analyzed using only status (parent/student) and weakness. This analysis yielded a statistically significant ($p<.01$) $\chi^2 = 192$. If the interaction between status and weakness is removed from the model, the model is not adequate. Parents cited instruction (Standardized Residual [SR] = 9.2) and equipment problems (SR = 2.2) as a weakness more frequently than expected and scheduling (SR = -7.1) and Student Behavior (SR= -4.1) less frequently than expected. Students, on the other hand, cited scheduling (SR = 3.1) more frequently than expected and instruction (SR = -4.1) less frequently than expected. These results are depicted in Figure 4.

Insert Figure 4 About here

Although it would have been desirable to analyze weakness responses by status, site, and

semester concurrently, when splitting responses into a 4 by 2 by 2 by 5, several cells contained very small or zero frequencies. Consequently, two further models were tested: weakness by status by site and weakness by status by semester.

When weakness responses were analyzed by status and site, the best fitting model contained a three-way interaction. If the three-way interaction were removed, 95% of the variance could still be explained but there was a statistically significant chi-square ($\chi^2 = 11.4$, df=3, $p<.05$). Further removal of the interaction between status and site ($\chi^2 = 16.4$, df=4, $p<.05$) provided a model explaining approximately 93% of the variance. Statistical results produced by removal of the interactions is displayed in Table 5.

Insert Table 5 About here

Because each previous yearly analysis had indicated a relationship between weakness and site an interaction effect between these was not surprising. And, because of the discrepancy in sample size between groups, it was not surprising to have an interaction between site and status. Approximately 25% of the student responses cited scheduling as a weakness compared to 5% of the parent responses. On the other hand, 40% of the parent responses referred to instruction as a weakness as compared to only 24% of the remote site student responses and 13% of the home site student responses (see Figure 5).

Insert Figure 5 About here

Weakness responses were then analyzed by semester and status. There was a three-way interaction between weakness category, status, and semester. Removal of this interaction resulted in a model in which 87% of the variance was explained ($\chi^2 = 53.3$, df=12, $p<.01$). Further removal of the interaction between semester and status provided a non-significant χ^2 change ($\Delta\chi^2 = 9.2$, df=4, $p>.05$). This model explained 84% of the variance. If, on the other hand, the interaction between status and weakness were removed in model 3 (see Table 6), the model would only explain 37% of the variance. The chi square change for removal of this interaction was statistically significant ($\Delta\chi^2 = 195.4$, df=3, $p<.01$).

Insert Table 6 About here

In 1995, 60% of the student responses cited equipment problems. There was a sharp decrease the next two semesters followed by a relatively constant proportion (25%). Conversely, 40% of the parent responses cited equipment problems in 1995, followed by a decrease and then a steady increase in proportion of parent responses citing equipment weaknesses. In addition, parents always cite instructional weaknesses with greater proportional frequency than students. Students always cite student behavior weaknesses and, after 1995, scheduling problems with greater proportional frequency than parents.

Insert Figure 6 About here

Conclusion

While there was no omnibus difference in perceived strengths between students and parents, when further classified by semester and site there were statistically significant interactions. This could be due in part to a different number of responses by site, status, and semester. Across semesters, however, parents and students reported different strengths. In addition, there was an omnibus difference in perceived weaknesses between students and parents. Therefore, open-ended questions concerning strengths and weaknesses should still be asked of both parents and students.

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Table 1

Frequency and number of Responses to the Strengths Question by Site and Semester/Year

		Home		Remote	
	Semester/Year	n=	Responses	n=	Responses
Students					
	Spring '95	48	94	32	48
	Spring '96	139	242	65	111
	Spring '97	83	237	55	150
	Fall '97	84	236	63	181
	Spring '98	219	610	146	418
Parents					
	Spring '95	9	14	11	16
	Spring '96	39	66	16	23
	Spring '97	23	31	18	30
	Fall '97	25	41	34	56
	Spring '98	54	89	45	68

Table 2

Variance Explained and Chi-Square Results for Strength Models with Status and Site

	Model	Q^2	ΔQ^2	χ^2	df	$\Delta\chi^2$	Δdf
1	Strength/Status/Site	1		0	0		
2	Strength/Status Strength/Site Status/Site	.91	.09	6.2	3	6.2	3
3	Strength/Site Status/Site	.78	.12	13.4*	6	7.2	3
4	Strength/Site Status	.69	.09	18.7*	7	5.3*	1
5	Strength Site Status	.00	.69	60.3**	10	41.6**	3

Note. *p≤.05. **p≤.01.

Table 3

Variance Explained and Chi-Square Results for Strength Models with Semester and Site

	Model	Q^2	ΔQ^2	χ^2	df	$\Delta\chi^2$	Δdf
1	Strength/Semester/Status	1		0	0		
2	Strength/Semester Strength/Status Semester/Status	.41	.59	192**	16	192**	16
3	Strength/Semester Semester/Status	.36	.05	206**	20	14.9**	4
4	Strength/Semester Status	.31	.05	224**	24	17**	4
5	Strength Semester Status	.00	.31	325**	40	101**	16

Note. *p≤.05. **p≤.01.

Table 4

Frequency and number of Responses to the Weakness Question by Site and Semester/Year

		Home		Remote	
	Semester/Year	n=	Responses	n=	Responses
Students					
	Spring '95	44	74	31	54
	Spring '96	122	209	65	114
	Spring '97	80	210	56	137
	Fall '97	84	219	62	167
	Spring '98	202	491	146	369
Parents					
	Spring '95	8	13	12	22
	Spring '96	34	53	14	16
	Spring '97	28	50	15	32
	Fall '97	13	15	32	56
	Spring '98	44	69	45	76

Table 5

Variance Explained and Chi-Square Results for Weakness Models with Status and Site

	Model	Q^2	ΔQ^2	χ^2	df	$\Delta\chi^2$	Δdf
1	Weakness/Site/Status	1		0	0		
2	Weakness/Site Weakness/Status Site/Status	.95	.05	11.4**	3	11.4**	3
3	Weakness/Status Weakness/Site	.93	.02	16.4**	4	5**	1
4	Weakness/Status Site	.78	.15	56.3**	7	13.3**	3
5	Weakness Status Site	.00	.78	251.5**	10	195.2**	3

Note. *p≤.05. **p≤.01.

Table 6

Variance Explained and Chi-Square Results for Weakness Models with Status and Semester

	Model	Q^2	ΔQ^2	χ^2	df	$\Delta\chi^2$	Δdf
1	Weakness/Semester/Status	1		0	0		
2	Weakness/Semester Weakness/Status Status/Semester	.87	.13	53.3**	12	53.3**	12
3	Weakness/Semester Weakness/Status	.84	.02	62.5**	16	9.2	4
	[Weakness/Semester [Status/Semester	.37	.49	248.7**	15	195.4**	3][a]
4	Weakness/Status Semester	.49	.55	202**	28	139.6**	12
5	Weakness Status Semester	.00	.49	397.2**	31	195.2**	3

Note. [a] If used instead of Model 3. *p≤.05, **p≤.01.

Figure 1

Strength Responses: Proportional by Status (Student/Parent)

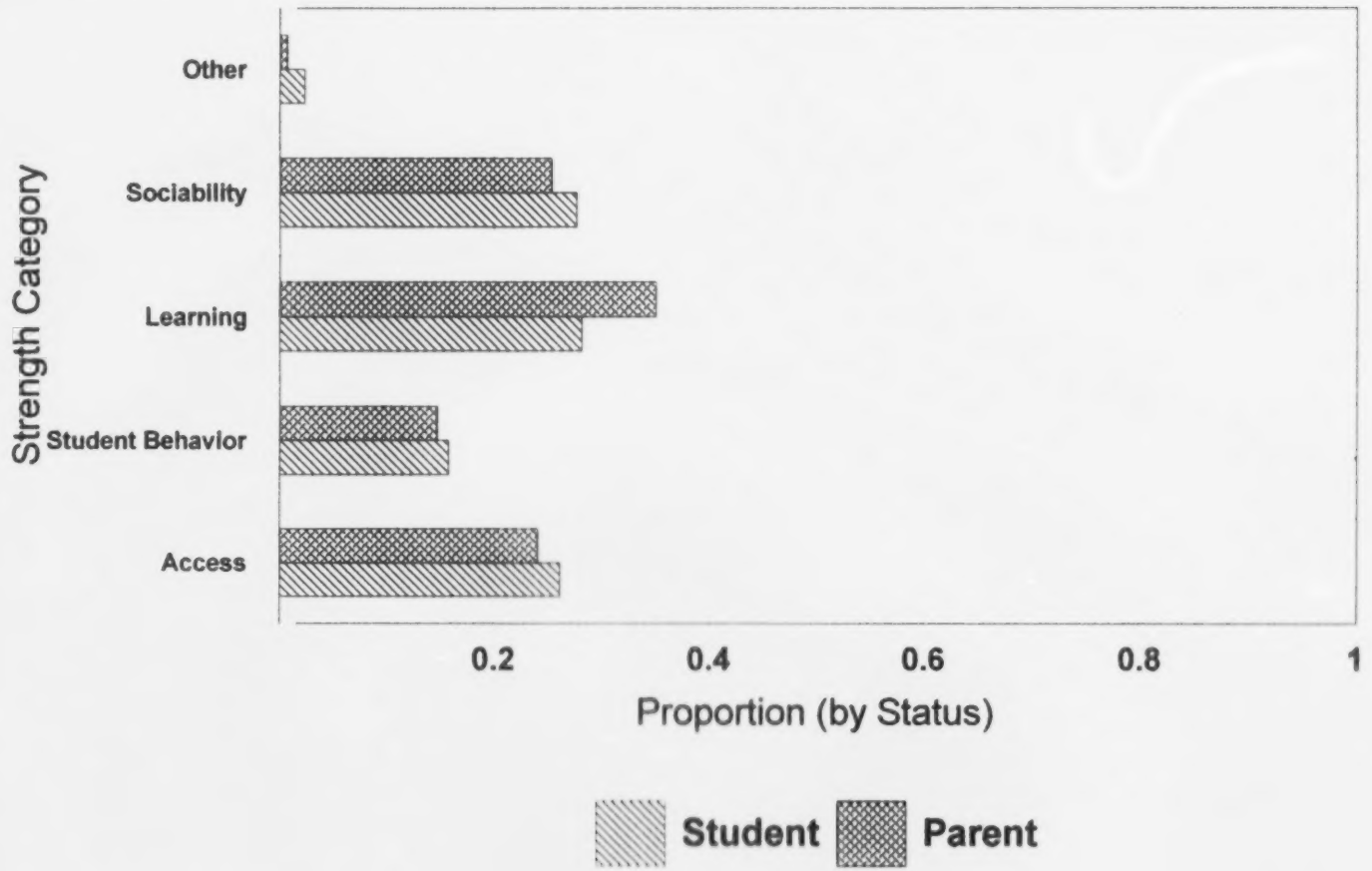

Figure 2

Strength Responses: Proportional by Parent/Student and Site

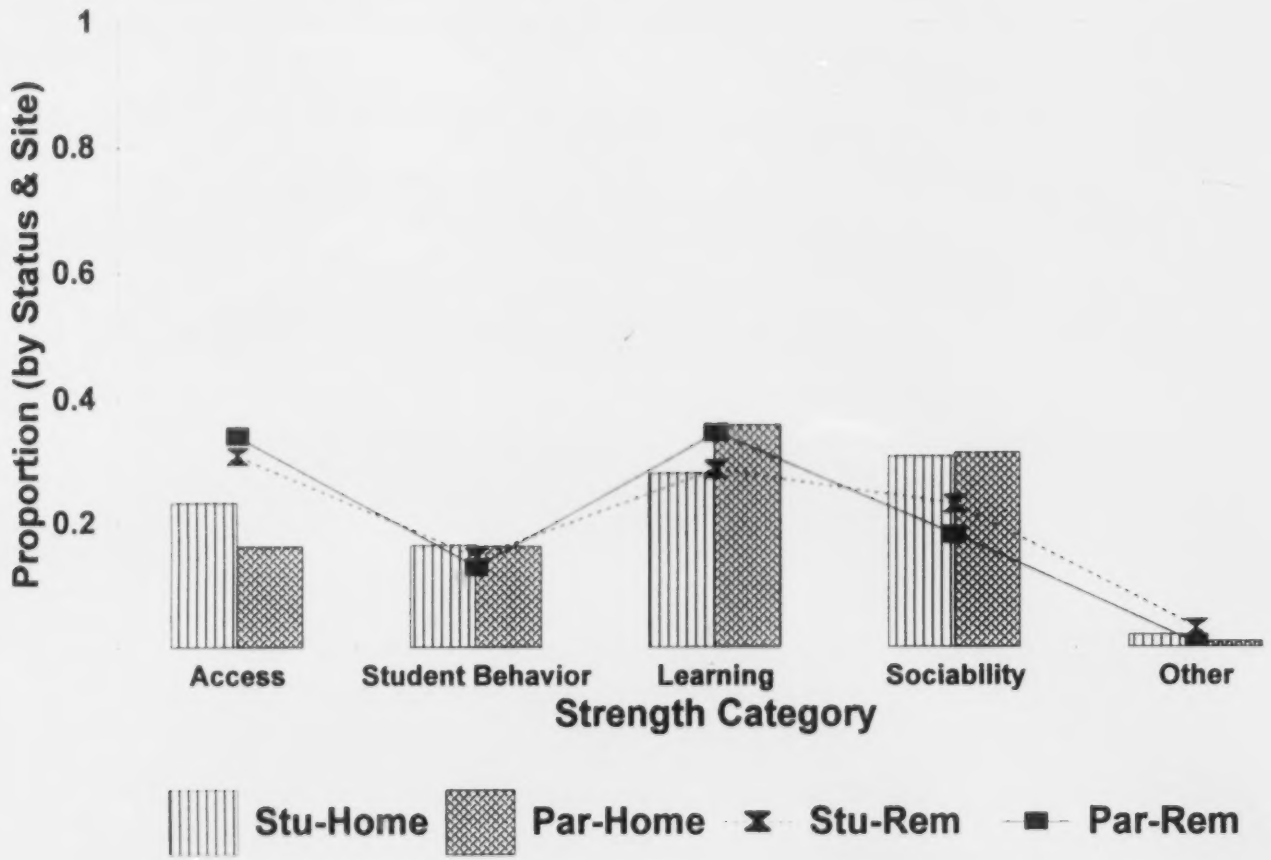

Figure 3

Strength Responses: Proportional by Status and Semester

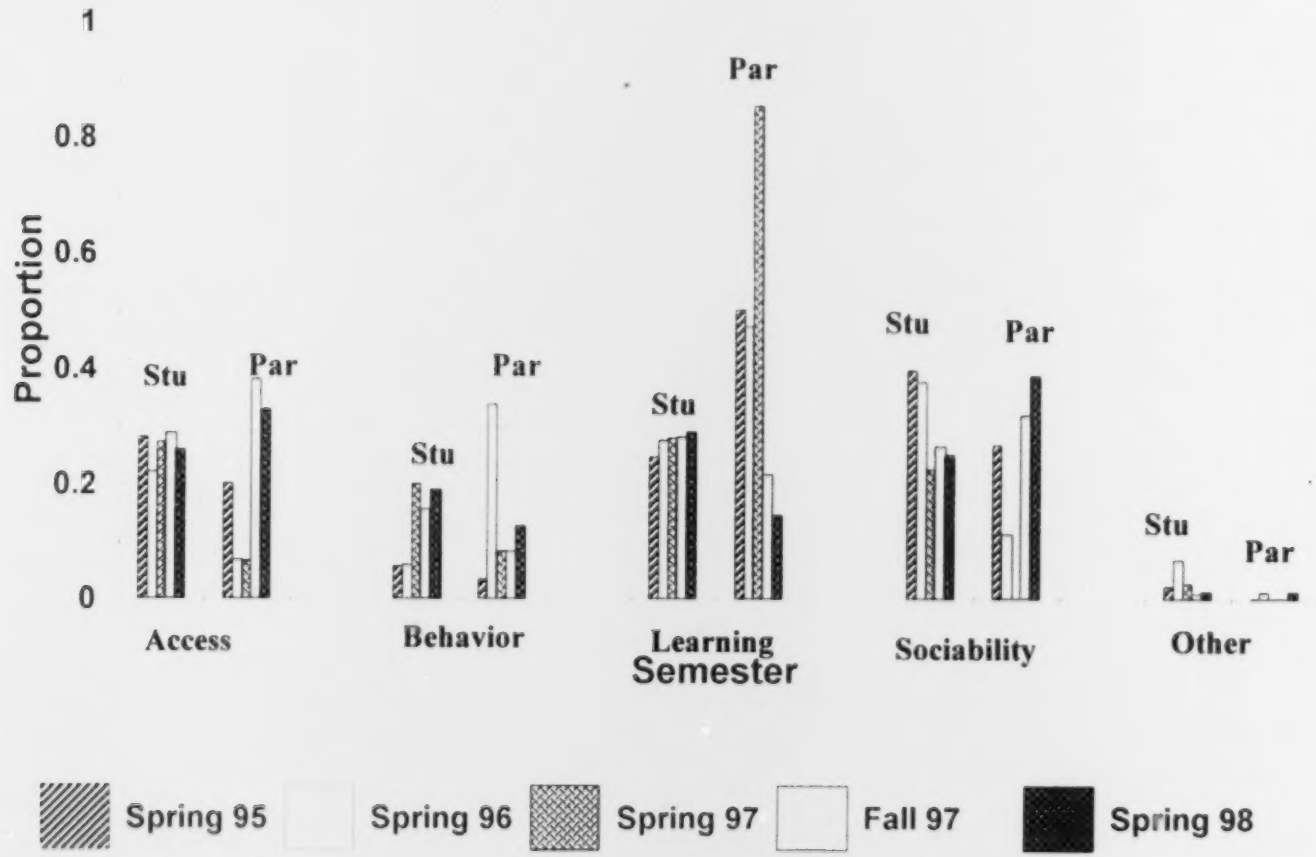

Figure 4

Weakness Responses: Proportional by Status (Student/Parent)

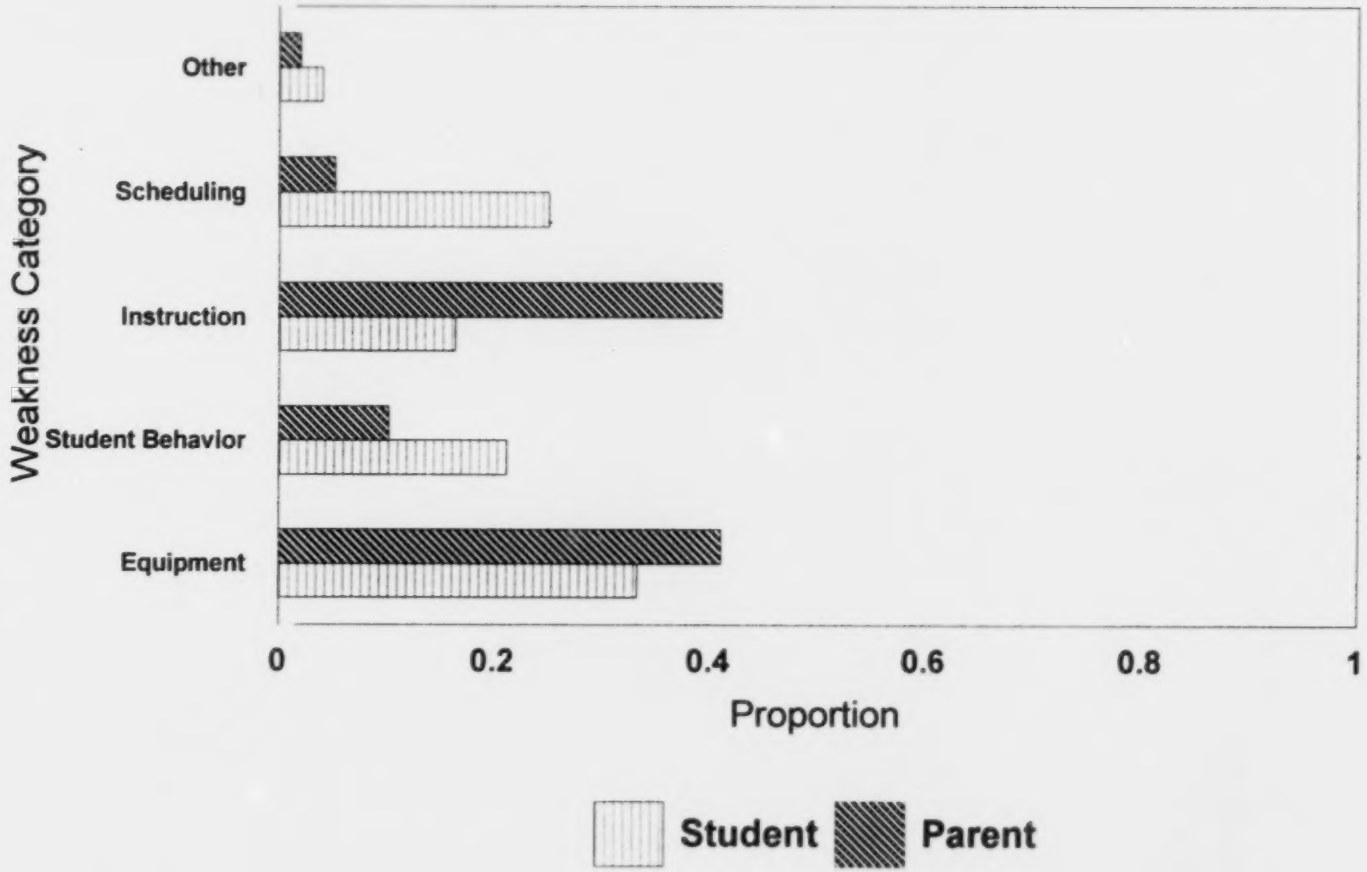

Figure 5

Weakness Responses: Proportional by Parent/Student and Site

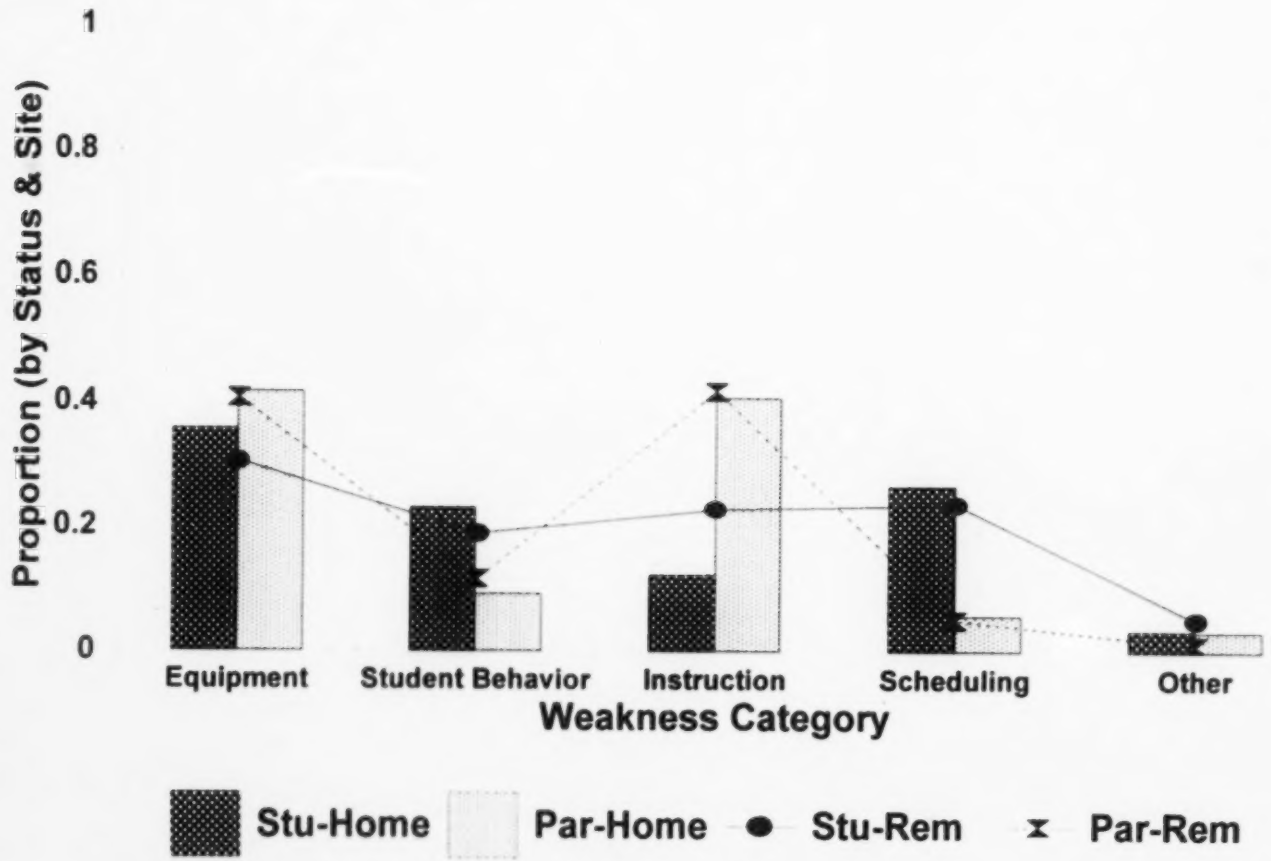

Figure 6

Weakness Responses: Proportional by Status and Semester